PB-216 577

THE STRUGGLE FOR CLEAN WATER. AN INTRODUCTION TO WATER POLLUTION AS A PROBLEM IN CONSERVATION, HEALTH, AND WATER RESOURCE MANAGEMENT

Office of Education
Washington, D. C.

1962

DISTRIBUTED BY:

NTIS

National Technical Information Service
U. S. DEPARTMENT OF COMMERCE
5285 Port Royal Road, Springfield Va. 22151

PB 216 577

today's health problems

a series for teachers

number one

the STRUGGLE for CLEAN WATER

Reproduced by
NATIONAL TECHNICAL INFORMATION SERVICE
U.S. Department of Commerce
Springfield VA 22151

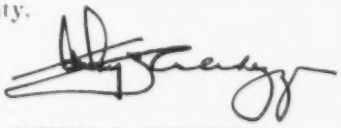
THIS PUBLICATION is the first in a series designed to provide educators and students with information concerning recent developments in vital health and welfare fields.

Water pollution is a major threat to our present health and welfare and will inevitably concern our young people in the years to come.

We all need clean water—to drink, to grow our food, to wash in, to play in, to generate power for our industries and refine its products. But pollution is destroying this precious resource of our Nation, and unless we clean up our rivers and streams and keep them clean, we will not have enough clean water to meet our needs.

This Department in its water pollution control activities is working to meet what President Kennedy has described as our Nation's water goals: "to have sufficient water, sufficiently clean, at the right place and at the right time."

It is my hope that this guide will help the teacher explain the problem of water pollution—and the need for clean water—to his students and discuss with them what can and must be done about it by cooperative action in their community.



ANTHONY J. CELEBREZZE
Secretary of Health, Education, and Welfare

Public Health Service Publication No. 958 ● 1962

the STRUGGLE for CLEAN WATER

An introduction to water pollution as a problem in conservation, health, and water resource management

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Departmental Committee on Health of the School Age Child

Public Health Service
Office of Education
Children's Bureau

Washington 25, D.C. 1962

1. CAUSES AND EFFECTS OF WATER POLLUTION

WATER POLLUTION—and shortages of clean water—affect the everyday life of every one of us, no matter what our interests are or where we live.

In the winter of 1961, an outbreak of virus hepatitis on the Gulf coast was traced to oysters harvested in polluted water. Several months later, cases occurred on the Atlantic coast, this time from polluted clams.

In the Southwest, salt brine is limiting public water supplies and contaminating water which could be used by agriculture and industry.

In suburbs all over the country, detergent foam is a familiar sight on the surfaces of rivers and streams, the product of home laundries and dishwashers.

In every State, mile after mile of stream is being lost each year to fishing and useful aquatic life, and millions of fish are being killed.

In many cities, drinking water is becoming less and less palatable because of pollutants in the water supply.

And in every city, bathing beaches, picnic areas, and boating marinas are less attractive and less safe for the people to use.

These are symptoms of an impending water shortage, a shortage caused not by drought but by pollution. We are still getting as much rain as we always did. Our lakes and streams are as large as they ever were, and we have more and larger dams to impound water. Yet we are finding it more and more difficult to get the quality of water we need, where we want it, at the right time.

Water pollution is a hazard to our health, a threat to our economic growth, and a disgrace to the American people. Today, every-

thing in our society is conspiring to increase the amounts and perils of the wastes we dump into our water—our growing population, our new industrial techniques and products, our new methods of agriculture. Yet paradoxically, these same forces are also increasing our need for dependable supplies of clean water.

Because we have more people, we use more water. Because more of us live in cities and have higher standards of living, the demands upon our municipal water supplies have increased. Because we consume greater amounts and varieties of food, farmers irrigate more. Because factories are producing more goods and more complex products, industrial use of water increases every year and the problems of waste and product disposal become more difficult. Because we have more leisure, more of us seek to enjoy water sports at the same time that our recreational water areas are being reduced.

We do not have enough "new" water to meet all our needs: we have to use water over again. The number of persons in the country who are drinking "used" water is increasing. Along the Ohio River during certain times of the year, water is used nearly four times as it passes from Pittsburgh to Cairo. As time goes on, water reuse will become increasingly common; indeed, unless this does occur, there will not be enough water to go around.

So far, man has been able to take almost any "used" water and make it safe and at least moderately palatable by treating it with disinfectants and subjecting it to other chemical and physical processes. But as pollution continues to grow and as more complex contaminants find their way into our water supplies, this becomes increasingly expensive and difficult and the resulting product becomes poorer in quality.

Let us examine the situation in detail:

1. Our population is growing. In 1900, there were 76 million Americans. In 1950 our population was 150 million; in 1960 it was 180 million. By 1970 it is expected to reach 214 million; in 1980, about 260 million. Obviously the more people there are in the country the more water will be used.

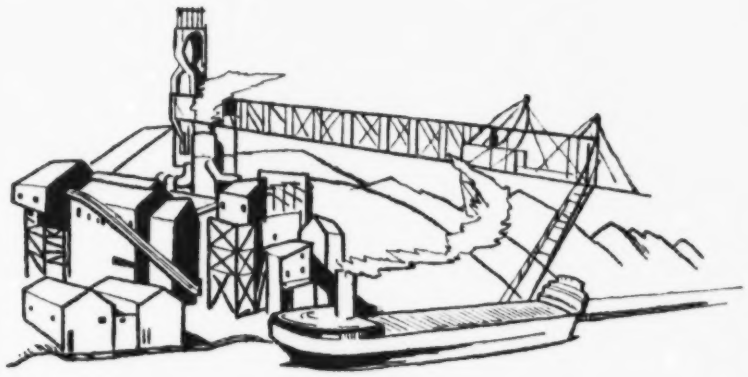
2. The amount of rainfall varies greatly from region to region and from one season to another. The rain forests of the State of Washington, for example, receive more than 100 inches of rain a year, while Death Valley in California gets less than 2 inches. Most of the rainfall is in the eastern part of the country, but our highly mobile population is moving toward the West, the more arid region.

3. We have become a nation of concentrated communities, with nearly half our population crowded on 1½ percent of our

land surface. Municipal demands for water are nearly eight times the 1900 level, reflecting in part the larger urban population and in part our higher standard of living and our growing industry. Bathrooms, kitchens, and home laundries use far more water than a generation ago. In communities without sewers, houses discharge wastes into the same underground reservoirs from which supplies are pumped—and kitchen sinks often fill up with foaming suds from synthetic detergents which have seeped from cesspools and septic tanks into the ground water.

4. Irrigation uses 141 billion gallons of water each day, compared to only 22.2 billion gallons in 1900. But whereas no more than 12 percent of the water in city use is depleted—that is, evaporated or transpired to the atmosphere—about 60 percent of the water used in irrigation is depleted and thus not recoverable for reuse. And what is returned to the watercourses often is laden with salts, other minerals, and chemicals.

5. City and agricultural needs for water have increased greatly but they are minor in comparison with the staggering increase in water use by industry. Since 1900 this country's industrial production has risen more than 9 times, and its estimated use of water is 11 times greater. In 1960, industry used 160 billion gallons of water per day; by 1980, this will jump to 394 billion. Water has many different uses in industrial production—as a power source, as a coolant, as a transporting device, as an ingredient, as a washing agent. And our factories use water in amounts that are astonishing to the average person. For instance, it takes approximately 1,400 gallons of water to produce a dollar's worth of steel, and nearly 200 gallons for a dollar's worth of paper. The manufacture of 1 yard of woolen cloth requires about 500 gallons of water; for a ton of aluminum it takes 320,000 gallons.



6. The fastest growing elements in modern industry are those concerned with new products and new chemical substances. In the last 25 years, chemical production has expanded three times as fast as the rest of the economy. The wastes incurred in this production are extremely difficult to remove, and an even greater problem, in the long run, consists of disposing of the products after they have been used. Some of the detergents, herbicides, and pesticides inevitably return to surface or underground waters after they have been used in the kitchen, or washed off cropland or out of barns, and eventually they may end up in our drinking water. It is difficult to detect, classify, and remove these substances by present procedures; although their concentration is small, the cumulative effects of some of them may be dangerous to health.

"When in the space of 50 years," one authority wrote not long ago, "you double the population, concentrate two-thirds of it in urban communities . . . and multiply total industrial production by 900 percent, you are bound to have entirely new environmental problems. As a matter of simple arithmetic, that is what has happened in the United States." The resulting jamming together of sewer outlets and water intakes, the general boom in industry, the manufacture of new chemical substances that are throwing complex new elements into our streams, lakes, and bays—all these require greater and greater efforts to abate the pollution of our water.

2. THE TECHNOLOGY OF WATER POLLUTION CONTROL

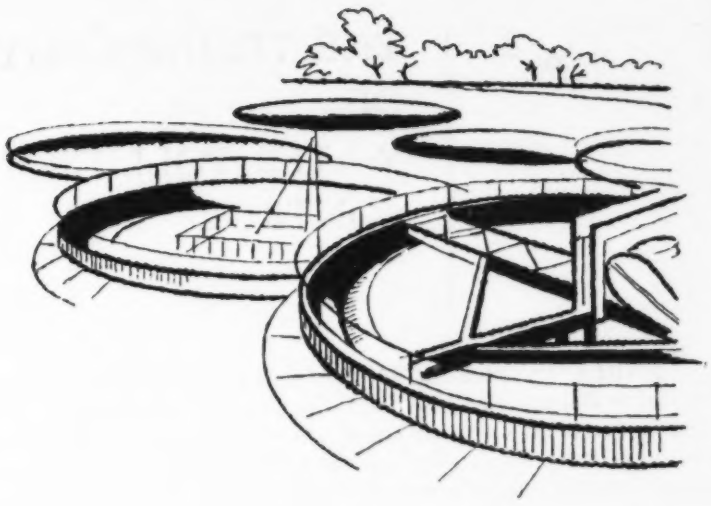
EARLY IN THE 19TH CENTURY, the growth of cities here and in Europe led to the fateful decision that wastes should no longer be carted to the outskirts of town but should be carried by sewer pipes from the factory and the home, and eventually be discharged into the most convenient stream. Thus the water-carriage system of sewerage was born. In present-day language, it was a crash program, forced upon the cities by the Industrial Revolution as a massive influx of people came to seek employment in new mills and factories.

No one weighed the possible consequences of emptying large amounts of putrescent matter into the watercourses of the land. In fact, no one then could have conceived of the size that cities would eventually reach, the tremendous amount of wastes they would generate, and the acids, minerals, and chemicals that refineries, paper mills, mines, and other industries would pour into these waterways.

As time went on, and as the streams became steadily more noxious, cities—some cities—took remedial action. They built waste treatment plants. The most efficient of them utilize two processes—a physical separation and screening of the waste water, followed by bacterial treatment of this water. The processes are known as primary and secondary treatment. In addition, the resulting water often is purified by adding chlorine.

During primary treatment, water is passed through a screen which catches such large objects as sticks and rags. Then the water flows slowly through a chamber which allows sand, gravel and other heavy objects to settle. It then flows into a large settling tank where it stands for a considerable time. The solids settle to the bottom or rise to the top. The water between these two layers is then drained off and discharged into the waterway.

Secondary treatment depends on the action of bacteria to remove dissolved organic matter from the water. For this purpose



a trickling filter, a bed of coarse stones on which bacteria grow, is often used. The water coming from primary treatment is sprayed over these stones and allowed to trickle through them. The bacteria do their work as the water trickles down. The water is drained off the bottom of the bed.

The activated sludge treatment is an alternate treatment which hastens bacterial action by exposing the sewage water to abundant atmospheric oxygen. The sewage water may then be sent into another settling tank, where the remaining solids settle, after which the treated waters are ready for discharge into the river or stream.

A somewhat different way of treating wastes utilizes natural processes in lagoons. This is now common in areas where land values are relatively low, where soils are favorable, and pollution loads not too heavy. In this method, waste waters are introduced into large, shallow, man-made lakes where a balanced biological system of algae and bacteria breaks down the pollutants.

When sludge is removed from any of these treatment processes and properly treated and dried, it can be used for land fill or fertilizer.

There are three shortcomings to waste treatment plants:

In the first place, there are not enough of them. One-fourth of our municipalities still discharge their wastes into the most con-

venient stream without giving them any treatment whatsoever. Another 31 percent provide only primary treatment. Approximately 7,500 municipal sewage treatment plants are now operating in this country; if our water sources are to be improved materially, authorities state that we must build, enlarge, or modernize almost 6,000 more.

Secondly, our waste treatment plants are not efficient enough. Primary treatment at best removes 35 percent of the organic wastes (of animal or vegetable origin) and secondary treatment removes up to 90 percent. (In terms of total wastes, organic plus inorganic, they remove much less than this.) It is obvious that, with cities and industries the size they are today, there is still an enormous amount of pollution being thrown into our rivers and streams. The pollution load in our rivers is already six times as much as it was 60 years ago.

Thirdly, since the procedures of waste treatment plants are based mainly on bacterial action, they have difficulty in removing many of the new pollutants found in waste water today. Even common salt cannot be removed by existing waste treatment processes. A great effort is being made to find an economical means of water desalinization, so that arid areas of the world near the sea can begin to draw upon the ocean for fresh water.

Treatment plants also have difficulty in removing wastes resulting from the use or manufacture of such new substances as plastics, detergents, nylon and similar fibers, pesticides, herbicides, and medicines. The plants are ineffective against other mineral and chemical substances, such as acids produced by mine drainage; against radioactive substances, and of course, heat, which harms aquatic life by affecting the metabolism of fish and by lowering the water's ability to hold oxygen.

In the years ahead, industry's building and modernization job for control of its wastes is probably as big or bigger than that of cities. Studies and surveys by the Public Health Service in recent years indicate that the amount of organic industrial wastes (treated and untreated) now going into the Nation's watercourses is about double the amount of municipal wastes. There have also been large increases in the discharge of the "common" inorganic wastes (principally of mineral and chemical origin) as well as increases in the amounts of new chemical wastes.

3. A PROGRAM TO ABATE WATER POLLUTION

CONTROLLING WATER POLLUTION calls for many things. It requires that farmers, loggers, road builders, and others continue and intensify present water conservation practices. Vegetation and forest cover must be provided for soil; dams and levees in suitable areas must be built where this has not yet been done; and soil erosion, careless run-off, and silting must be prevented.

Controlling water pollution also requires the introduction or expansion of procedures for reusing water in industrial operations and for conserving water in irrigation. In fact, we must renovate and renew used water in every possible way. As mentioned earlier, water is already being used over and over again in many areas; by 1980 this will be common practice almost everywhere. To prepare for this, in the face of ever-mounting population and industrial demands, will require the building and modernization of waste treatment plants in greater numbers than ever before, law enforcement, and significant advances in the technology of separating wastes from water. There must also be a greater public awareness of the problem.

Construction

Except for a short period during the depression days of the 1930's, this country has never built waste treatment facilities fast enough to keep up with needs. During the 1950's, city expenditures should have averaged $510 million a year to meet current needs; instead, they amounted to only $220 million a year up until 1956 and $360 million a year thereafter. Industry fell similarly behind during this period.

The upturn for cities started with the Federal Water Pollution Control Act of 1956, which for the first time permitted the Federal Government to join with local governments in financing sewage treatment facilities. Legislation now permits the Federal Government to contribute up to 30 percent of the costs of a project, or $600,-

000, whichever is less. Cities which combine to build a joint project may obtain a total Federal grant up to $2,400,000.

During the first 5 years of the Federal program, grants of $225,000,000 were made to 2,746 communities to help build $1.3 billion worth of plant construction and modernization. These plants will serve 27 million people and will help clean up 33,000 miles of rivers.

Construction grants are administered jointly by the Federal Government and by the State water pollution control agency. Allocations to States are determined by a formula based on population and per capita income.

The program is an incentive program, and the basic responsibility for cleaning up its waste waters remains with the local community. The cost will be high. Needs are estimated at $600 million a year during the next 10 years to build more than 4,200 plants and to enlarge or modernize another 1,000.

Law enforcement

Law enforcement is as necessary in curbing water pollution as it is in managing other conservation and natural resource matters. Both the States and the Federal Government can bring legal action against polluters. Different States have different procedures. Federal action proceeds through a conference, then, if necessary, a formal hearing, and finally (again, if necessary), suit in a Federal court.

Since 1956, 24 States and the District of Columbia, with some 250 cities, 235 industries, and 4,000 miles of streams, have been or are being affected by Federal procedures. Included have been such long-standing pollution problems as the Potomac River near Washington, D.C., the Mississippi River at St. Louis, and the Columbia River at Portland, Oregon.

Federal enforcement procedures are initiated either as the result of the findings of the Secretary of Health, Education, and Welfare, or upon request of a State which believes that the health and welfare of its residents are being endangered by pollution of interstate waters coming from another State. Federal action can now also be initiated in intrastate cases whenever a governor requests it.

Research

Intensive and increased research is needed to discover better and more efficient techniques for treating or conserving water.

One of the most exciting of such searches is now going on at the Public Health Service's sanitary engineering laboratories in Cincinnati, Ohio. Scientists there, and others working with the Service at universities and in private industry, are experimenting with a wide range of physical and chemical methods for removing wastes at their source. The goals of this project, called the Advanced Waste Treatment Research Program, are to find economical ways of removing all waste materials and to concentrate the residues in such small form that they can be easily and permanently disposed of, leaving an entirely potable water.

Among the techniques being explored are adsorption, electrodialysis, evaporation, solar distillation, hydration, oxidation, ion exchange, and even electrolysis. Most of these separation techniques are perfectly feasible in the laboratory; the problem is to apply them to huge volumes of wastes at costs that would make them economically feasible.

More and more of our rivers are now being monitored regularly for bacteria, chemical pollutants, and radioactivity. The Public Health Service alone maintains some 100 stations, mostly on interstate waters, while the U.S. Geological Survey, river basin agencies and individual States and cities supplement this with hundreds of other checkpoints. Eventually it is hoped that all our rivers and watercourses will be subject to constant automatic checking and evaluation.

At the same time, industries with problems of waste and product disposal are working to develop means of disposing of wastes and sometimes recovering useful byproducts of wastes from water which otherwise might pollute streams and endanger aquatic life. Many industries are finding ways to use less water in manufacturing processes, thus reducing their waste volume. Work also is being carried on to

evaluate the effect of new chemicals and new products on water quality before they are released to the public. New techniques for removing mineral and chemical pollutants, and in the design of waste treatment facilities, are being studied constantly by States and the Federal Government, and, under contract, by universities and research agencies.

An important new field in water quality research is the study of dams and man-made water impoundments to improve stream quality. The use of "low flow augmentation" permits water stored during normal periods to be used during periods of drought to dilute and flush wastes away. Federal law requires that low flow augmentation be one of the criteria in all future planning of Federal reservoirs. The law specifies, however, that flow augmentation is not to be used as a substitute for adequate waste treatment.

Cooperative planning

The complicating factor in our water problem is that water refuses to recognize city, State, or national boundaries. It simply flows downhill. When a city fails to clean up its own wastes, the chief victim is not the city itself but its neighbor downstream; similarly, when the city meets its responsibilities, it is the neighbor which benefits most.

The answer to this is cooperation, founded on widespread public recognition of the evils of pollution. It takes many forms. Both in law and in practice, this country's attack on water pollution is a joint Federal, State, and local function. Responsibility of the Federal program is lodged in the U.S. Department of Health, Education, and Welfare, with administration being conducted by the Public Health Service. State programs vary from one State to the next, but are usually administered by State Health Departments and Water Pollution Control Boards. At the local level, programs are directed by the City Engineer and City Health Departments.

Many States have joined with others to form interstate compacts, enabling them to discuss and meet the problems that affect them all. These compacts cover important areas; a typical one is the Interstate Commission on the Potomac River, which enables Maryland, Virginia, Pennsylvania, West Virginia, and the District of Columbia to develop and carry out joint programs for controlling water pollution on this river.

Cooperation is also the basis for the several comprehensive river basin studies which are now under way and which involve industries, municipalities, State and Federal agencies, and research institutions. One such plan is now being drawn up within the Arkansas-

Red River Basin which involves 180,000 square miles lying principally in Kansas, Oklahoma, and Texas. A cooperative study has been developed involving all these States, their municipalities and industries, and a number of Federal agencies including the U.S. Geological Survey and the U.S. Army Corps of Engineers.

Somewhat similar studies are now going on in the Colorado River Basin, the Columbia River Basin, the Great Lakes-Illinois Waterway area, the Delaware Estuary, and Chesapeake Bay. These studies require from 2 to 6 years and cost from $2 million to $12 million. They develop a systematic plan for maximum water use for all purposes over the longest possible period.

The need for public awareness

For water pollution control programs to succeed, we must have an informed and aware public, which understands the problem and supports the necessary programs of action. To gain this, it is necessary to show the public the dimensions of the problem and demonstrate ways of solving it. People in each community must become aware of what is happening to their own waterways—and realize that the same thing is happening in other areas. They must understand

that clean water safeguards health, promotes industry, is vital to agriculture, and provides better recreation.

The teacher can encourage his pupils to study the problem of water pollution as it exists in the local community, State, interstate, or river basin. For the teacher who wishes to increase his own understanding of the problem, relevant material can be obtained from the Division of Water Supply and Pollution Control, Public Health Service, U.S. Department of Health, Education, and Welfare, Washington 25, D.C., while on the local level, State and interstate agencies can be of great help. A list of these agencies, which are responsible for water pollution control activities, is attached.

appendix

STATE AND INTERSTATE WATER POLLUTION CONTROL AGENCIES*

ALABAMA

Water Improvement Commission
State Office Building
Montgomery 4, Ala.
Technical Secretary

ALASKA

Division of Health
Department of Health and Welfare
Alaska Office Building
Juneau, Alaska
Director

ARIZONA

State Department of Health
State Office Building
Phoenix, Ariz.
Commissioner of Public Health

ARKANSAS

State Water Pollution Control Commission
921 West Markham
Little Rock, Ark.
Director

CALIFORNIA

State Water Pollution Control Board
Room 316, 1227 "O" Street
Sacramento 14, Calif.
Executive Officer

---

*Designated to receive Federal Water Pollution Control Grants.

COLORADO

State Department of Public Health
4210 East 11th Avenue
Denver 20, Colo.
Director of Public Health

CONNECTICUT

Water Resources Commission
State Office Building
650 Main Street
Hartford 15, Conn.
Director

DELAWARE

State Water Pollution Commission
State House Annex
Governor's Avenue and Division Street
Dover, Del.
Executive Officer

DISTRICT OF COLUMBIA

District of Columbia Department of Public Health
401 3d Street NW.
Washington 1, D.C.
Chief, Bureau of Environmental Health

FLORIDA

State Board of Health
1217 Pearl Street
Jacksonville 1, Fla.
State Health Officer

GEORGIA

Georgia Department of Public Health
State Office Building
Atlanta 3, Ga.
Director

GUAM

Division of Public Health
Territory of Guam
P.O. Box 128
Agana, Guam
Chief Public Health Officer

HAWAII

Hawaii Department of Health
Kapuaiwa Building
P.O. Box 3378
Honolulu 1, Hawaii
Director of Health

647123°—62——2

IDAHO

Idaho Department of Health
State House
Boise, Idaho
Administrator of Health

ILLINOIS

State Sanitary Water Board
State Office Building
400 South Spring Street
Springfield, Ill.
Technical Secretary

INDIANA

Stream Pollution Control Board
State Board of Health
1330 West Michigan Street
Indianapolis 7, Ind.
Technical Secretary

IOWA

State Department of Health
State Office Building
Des Moines 19, Iowa
State Commissioner of Public Health

KANSAS

State Board of Health
State Office Building
Topeka Avenue at 10th
Topeka, Kans.
Executive Secretary

KENTUCKY

Water Pollution Control Commission
State Department of Health
Frankfort, Ky.
Director and Chief Engineer

LOUISIANA

Stream Control Commission
Box 9055, University Station
Baton Rouge 3, La.
Executive Secretary

MAINE

Water Improvement Commission
c/o Department of Health and Welfare
State House
Augusta, Maine
Secretary

MARYLAND

State Department of Health
State Office Building
301 West Preston Street
Baltimore 1, Md.
Chief, Bureau of Environmental Hygiene

MASSACHUSETTS

Massachusetts Department of Public Health
546 State House
Boston 33, Mass.
Commissioner of Public Health

MICHIGAN

Water Resources Commission
Station B
Reniger Building
200 Mill Street
Lansing 13, Mich.
Executive Secretary

MINNESOTA

Water Pollution Control Commission
State Department of Health Building
Campus, University of Minnesota
Minneapolis 14, Minn.
Secretary

MISSISSIPPI

State Board of Health
Felix J. Underwood State Board of Health Building
P.O. Box 1700
Jackson 5, Miss.
Secretary and Executive Officer

MISSOURI

State Water Pollution Board
112 West High Street
Jefferson City, Mo.
Executive Secretary

MONTANA

State Board of Health
Laboratory Building
Helena, Mont.
Executive Officer and Secretary

NEBRASKA

Department of Health
State Capitol Building
Lincoln 9, Nebr.
Director of Health

NEVADA

State Department of Health
Carson City, Nev.
State Health Officer

NEW HAMPSHIRE

Water Pollution Commission
61 South Spring Street
Concord, N.H.
Technical Secretary

NEW JERSEY

State Department of Health
129 East Hanover Street
Trenton 25, N.J.
State Commissioner of Health

NEW MEXICO

New Mexico Department of Public Health
Santa Fe, N. Mex.
Director of Public Health

NEW YORK

State Department of Health
84 Holland Avenue
Albany 8, N.Y.
Commissioner of Health

NORTH CAROLINA

State Stream Sanitation Committee
State Department of Water Resources
North McDowell Street
Raleigh, N.C.
Secretary

NORTH DAKOTA

State Department of Health
Capitol Building
Bismarck, N. Dak.
State Health Officer

OHIO

Water Pollution Control Board
306 Ohio Departments Building
Columbus 15, Ohio
Chairman

OKLAHOMA

State Department of Health
3400 Block of North Eastern
Oklahoma City 5, Okla.
Commissioner of Health

OREGON

State Board of Health
1400 S.W. 5th Avenue
Portland 1, Oreg.
State Health Officer

PENNSYLVANIA

Sanitary Water Board
Pennsylvania Department of Health
State Capitol
Health and Welfare Building
Harrisburg, Pa.
Chairman

PUERTO RICO

Department of Health
Ponce de Leon Avenue
San Juan 18, P.R.
Secretary of Health

RHODE ISLAND

Department of Health
State Office Building
Providence 2, R.I.
Director of Health

SOUTH CAROLINA

State Water Pollution Control Authority
Room 417, Wade Hampton Building
Columbia 1, S.C.
Executive Director

SOUTH DAKOTA

Committee on Water Pollution
State Capitol
Pierre, S. Dak.
Secretary and Executive Officer

TENNESSEE

Stream Pollution Control Board
Cordell Hull Building
Sixth Avenue, North
Nashville 3, Tenn.
Director

TEXAS

State Department of Health
1100 West 49th Street
Austin 5, Tex.
Commissioner of Health

UTAH

Water Pollution Control Board
45 South Fort Douglas Boulevard
Salt Lake City 13, Utah
Executive Secretary

VERMONT

Vermont Department of Water Resources
State Office Building
Montpelier, Vt.
Commissioner

VIRGINIA

State Water Control Board
415 West Franklin Street
Richmond 20, Va.
Executive Secretary

VIRGIN ISLANDS

Virgin Islands Department of Health
Charlotte Amalie
St. Thomas, V.I.
Commissioner of Health

WASHINGTON

State Pollution Control Commission
224 Old Capitol Building
Olympia, Wash.
Director

WEST VIRGINIA

Division of Water Resources
Department of Natural Resources
1709-A Washington Street, East
Charleston 1, W. Va.
Chief

WISCONSIN

State Committee on Water Pollution
State Office Building
Madison 2, Wis.
Director

WYOMING

State Department of Public Health
State Office Building
Cheyenne, Wyo.
Director of Public Health

INTERSTATE WATER POLLUTION CONTROL AGENCIES

ILLINOIS, MISSOURI

Bi-State Development Agency
915 Olive Street
St. Louis 1, Mo.
Chairman

DELAWARE, NEW JERSEY, NEW YORK, PENNSYLVANIA

Interstate Commission on the Delaware River Basin
Suburban Station Building
Philadelphia 3, Pa.
Executive Secretary

DISTRICT OF COLUMBIA, MARYLAND, PENNSYLVANIA, VIRGINIA, WEST VIRGINIA

Interstate Commission on the Potomac River Basin
Transportation Building
815 17th Street NW.
Washington 6, D.C.
Director

CONNECTICUT, NEW JERSEY, NEW YORK

Interstate Sanitation Commission
10 Columbus Circle
New York 19, N.Y.
Director and Chief Engineer

CALIFORNIA, OREGON

Klamath River Compact Commission
P.O. Box 388
Sacramento 5, Calif.
Executive Secretary

CONNECTICUT, MAINE, MASSACHUSETTS, NEW HAMPSHIRE, NEW YORK, RHODE ISLAND, VERMONT

New England Interstate Water Pollution Control Commission
73 Tremont Street
Boston 8, Mass.
Secretary

ILLINOIS, INDIANA, KENTUCKY, OHIO, PENNSYLVANIA, NEW YORK, VIRGINIA, WEST VIRGINIA

Ohio River Valley Water Sanitation Commission
414 Walnut Street
Cincinnati 2, Ohio
Executive Director and Chief Engineer

U.S. GOVERNMENT PRINTING OFFICE 1962